

# WIND POWER IN TURKISH POWER SYSTEM

 **HUSUM  
Wind**  
The German  
Wind Trade Fair  
and Congress  
15–18 Sept. 2015  
Husum, Germany

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**TURKISH ELECTRICITY TRANSMISSION  
CORPORATION (TEİAŞ)**



- The sole owner of Electricity Transmission System
- Responsible for the expansion of transmission network infrastructure & construction of new transmission facilities
- Operating & Maintaining the Turkish Electricity Transmission Network economically and reliably in compliance with international standards
- Monitoring real-time system reliability, purchasing and providing Ancillary Services Through “Ancillary Service Agreements”
- Publishing 10-year “*Electrical Energy Generation Capacity Projection*”
- Carrying out studies for the Interconnection Lines with neighboring countries
- ~~Operating the Electricity Balancing Settlement Market and Financial Reconciliation Center (PMUM)~~ [recently *unbundled as Exchange Market named EPIAŞ*]



## SUBSTATIONS

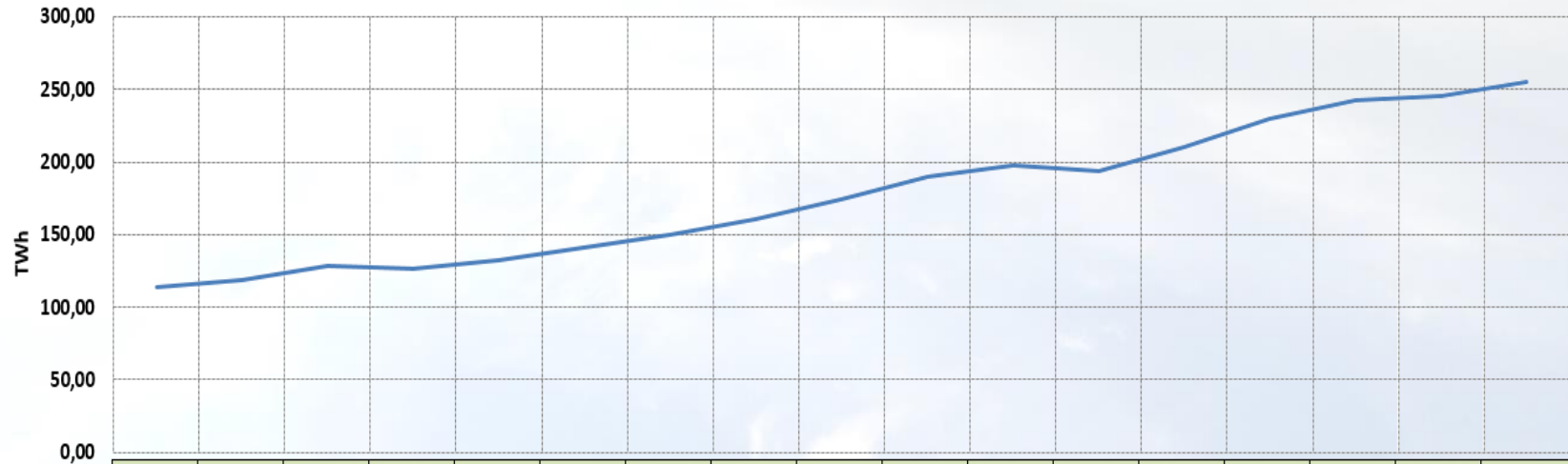
**400 kV : 92**  
**220 kV : 1**  
**154 kV : 568**  
**66 kV : 14**  
**Total : 675 Subs.**  
**with 125.898 MVA capacity**

## TRANSMISSION LINES

**400 kV : 17.429 km**  
**154 kV : 34.919 km**  
**220 kV : 85 km**  
**66 kV : 509 km**  
**154 & 400 kV Cable: 296 km**  
**Total : 53.238 km**



TURKEY ANNUAL TOTAL ELECTRICITY CONSUMPTION (TWh)



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CONSUMPTION (TWh)	114,00	118,50	128,30	126,90	132,60	141,20	150,00	160,80	174,60	190,00	198,10	194,10	210,40	230,30	242,37	245,48	255,54
INCREASE (%)	8,10	3,90	8,30	-1,10	4,50	6,50	6,30	7,20	8,60	8,80	4,30	-2,00	8,40	9,40	5,20	1,20	4,10



## Year 2013

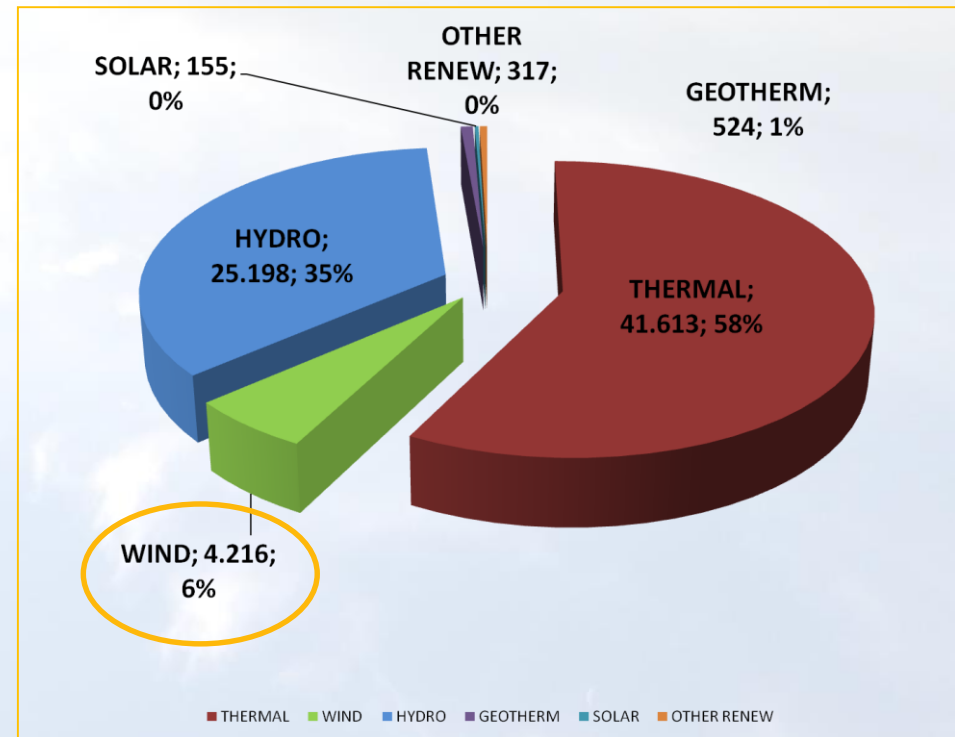
Installed Capacity:	64.612MW
Annual Consumption	245.48 TWh
Peak Load	38,264 MW (29.08.2013 14:20)

## Year 2014

Installed Capacity:	69.516 MW
Annual Consumption	255.55 TWh
Peak Load	41.002 MW (14.08.2013 14:30)

## Installed Capacity (Sept 2015)

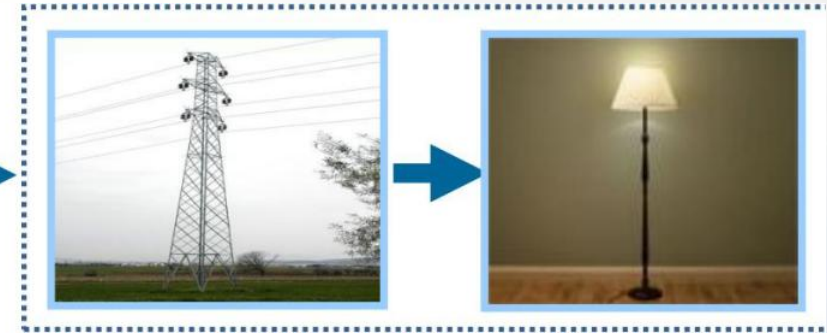
(MW)



Total: 72,022 MW







## GENERATION

**EÜAŞ**

**Private  
Companies**  
(- w/ License or  
-w/o License)

## TRANSMISSION

**TEİAŞ**

(Turkish Electricity  
Transmission  
Corp.)

## DISTRIBUTION

**Private  
Distribution  
Companies**  
(in 21 Regions)

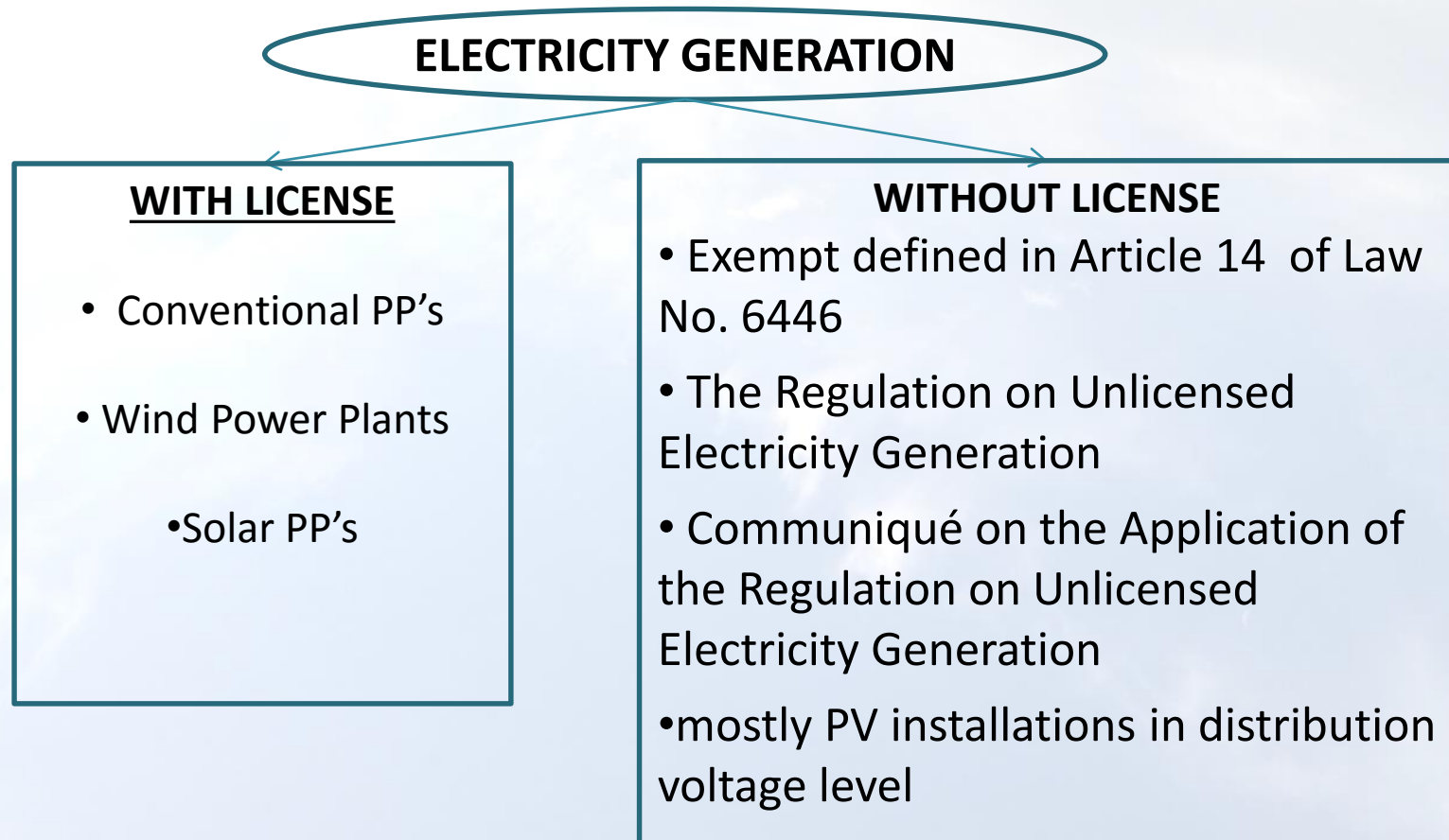
## TRADING

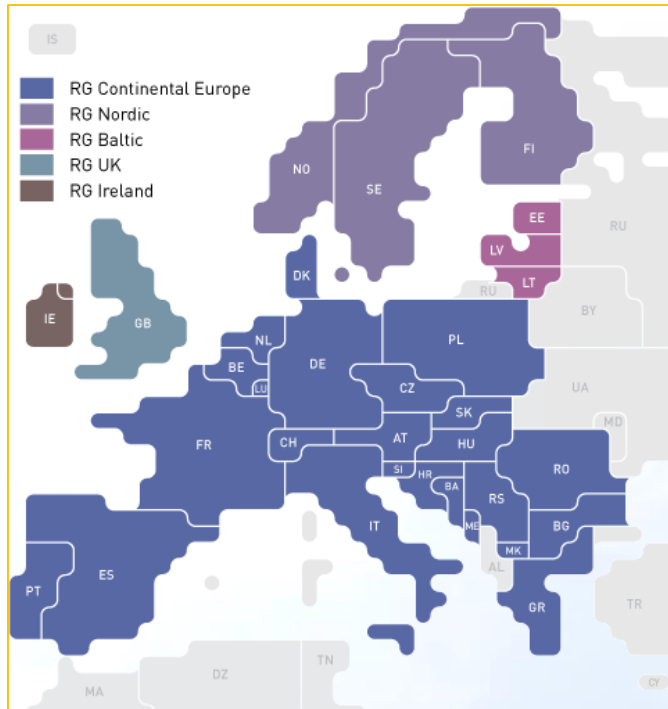
**TETAŞ**  
**Private  
Companies**

**ENERGY AUTHORITY (EMRA)**



Within the scope of the ***Electricity Market Law No.6446***, generation activities are divided into two, according to license status.





Milestone	Date
Contractual Agreement between ENTSO-E & TEİAŞ	18 December 2009
Isolated Operation Test (Peak Load)	11-24 January 2010
Isolated Operation Test (Min. Load)	22 March-5 April 2010
Synchronous Parallel Operation Test Phase 1,2,3	2010 - 2011
Increase of NTCs	17 April 2013
Decision for Permanent Synchronous Operation	9 & 24 April 2014
Signing of the Long Term Agreement	15th April 2015
Observer Membership process is initiated	18th June 2015





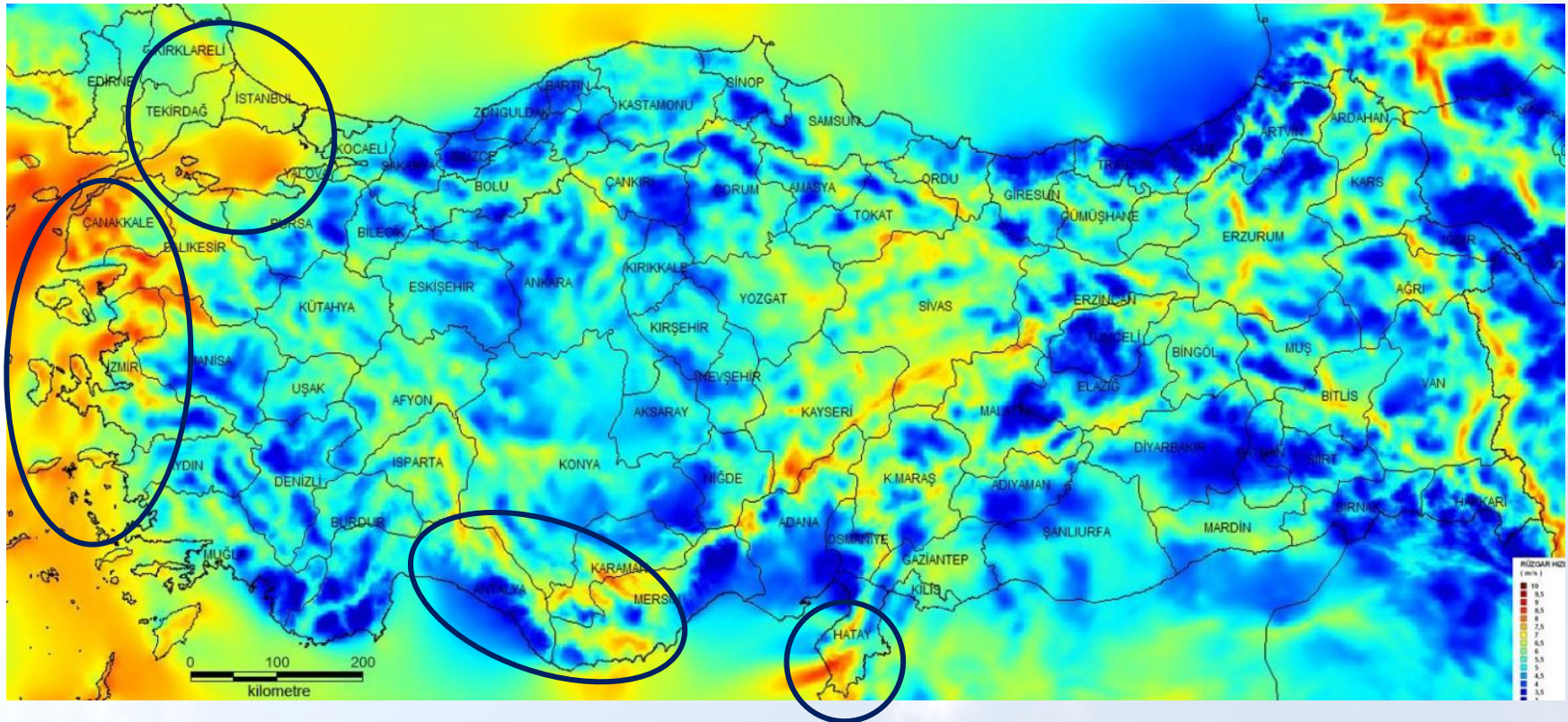


## Existing and Planned Interconnection Lines

- Current 400 kV lines
- 400 kV lines under construction
- Current 220 kV lines
- Current 154 kV lines



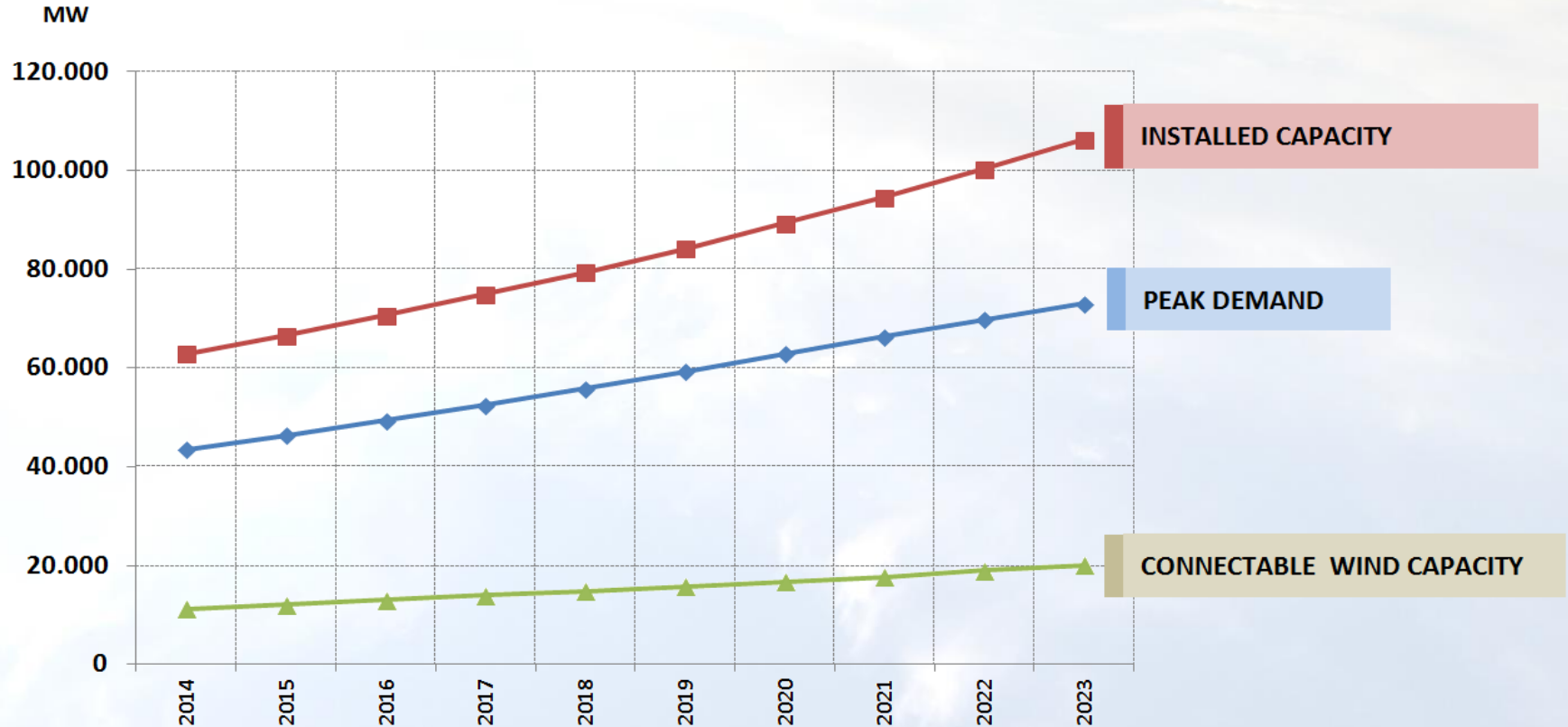
# WIND POWER IN TURKEY



The techno-economic wind potential of Turkey is **48 GW**, determined by General Directorate of Renewable Energy.

The locations with highest potential are in the Aegean, Marmara, and Eastern Mediterranean and Hatay.

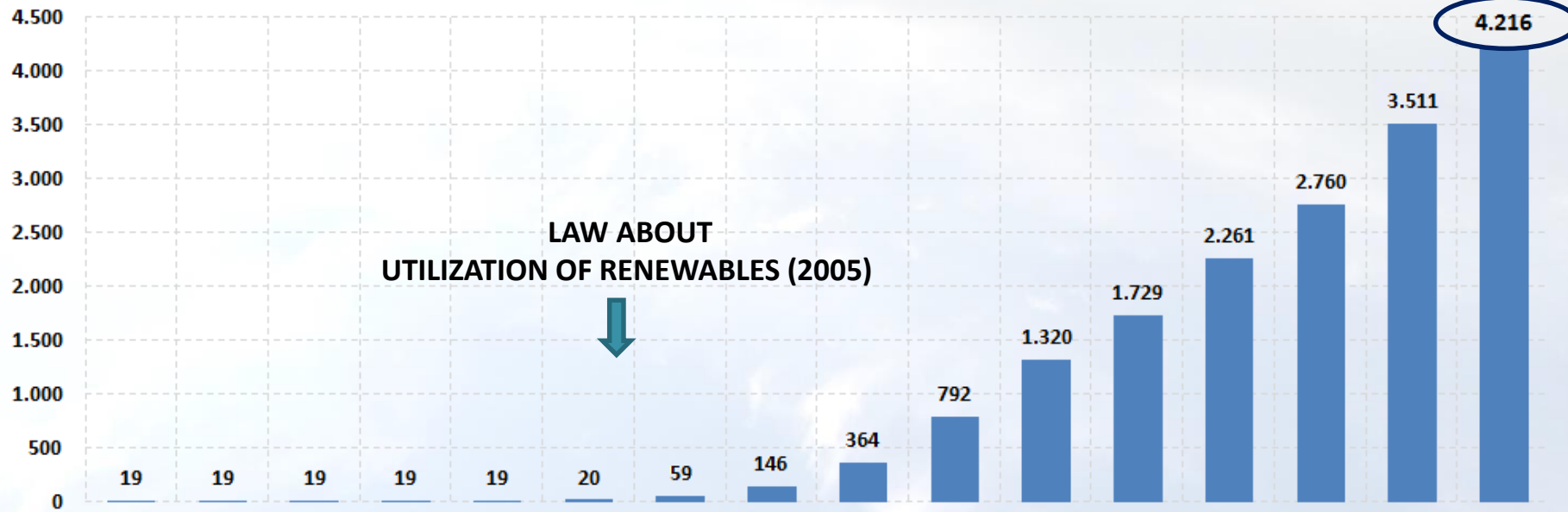




In accordance with the Ministry of Energy's Strategic Plan, Turkey is targeting **20,000 MW** installed wind-power capacity by the end of 2023.



## ANNUAL DEVELOPMENT OF WIND POWER INSTALLED CAPACITY IN TURKEY (MW)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
INSTALLED CAPACITY (MW)	19	19	19	19	19	20	59	146	364	792	1.320	1.729	2.261	2.760	3.511	4.216





## WPP STATUS

MW

IN OPERATION WPP's	4,216
EXTENSIONS APPROVED for IN OPERATION WPP's	978
HAS CONNECTION AGREEMENT with TEİAŞ	3,278
IN CONNECTION AGREEMENT PROCESSSSS with TEİAŞ	1,274
LICENSED by EMRA	780
PERMITTED for CONNECTION	1,157
TOTAL	11,682

## NEW CAPACITY AUCTIONS

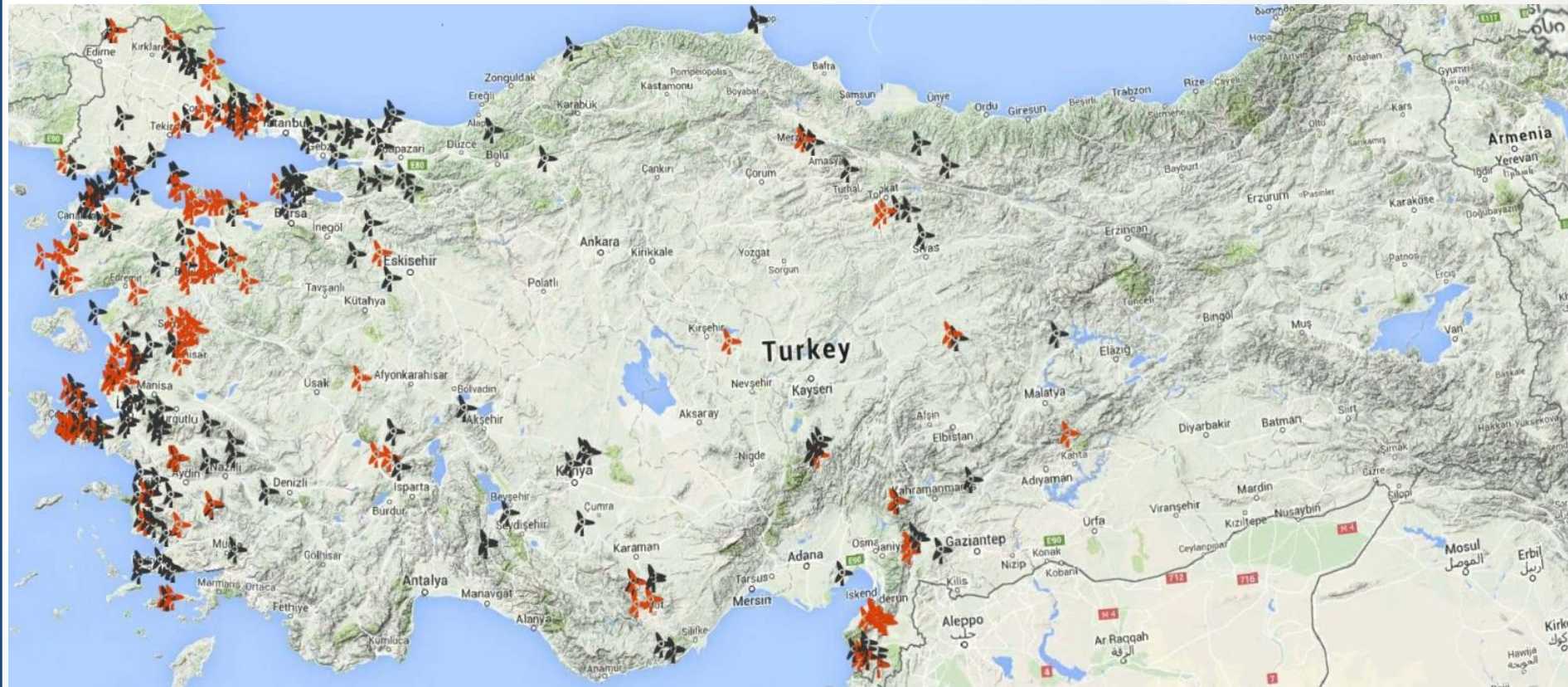
MW

Year 2013 (Application are taken by EMRA in April 2015 )	3,000
Year 2015 (Application will taken by EMRA in Oct. 2016 )	2,000





## Distribution of Wind Power Plants in Turkey as of Sept. 2015



**PLANNED + INSTALLED: ~12.000 MW**



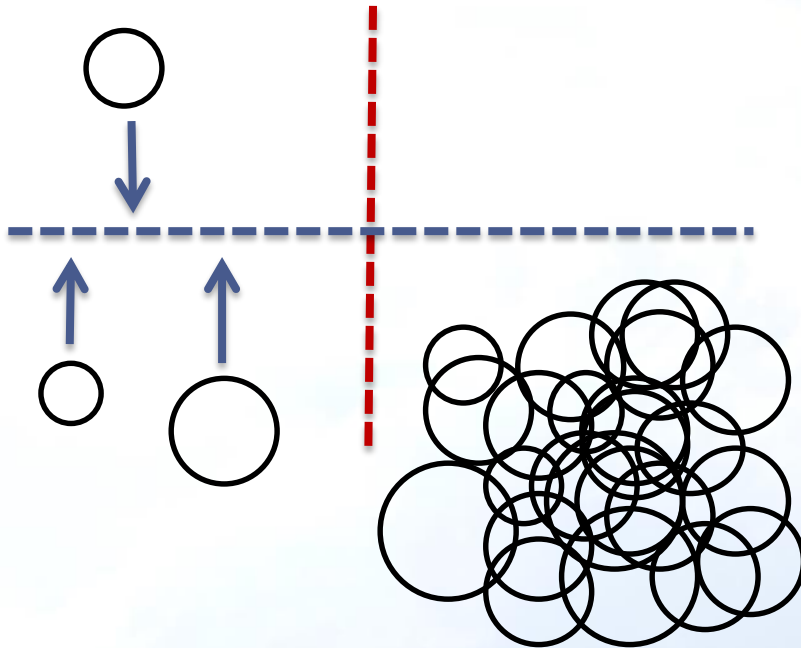
- The law on the Utilization of Renewable Energy Sources (RES) for the purpose of generating energy, (Law No. 5346 of 10/05/2005) is the first Renewable Energy Law of Turkey which was approved by the Turkish Parliament.
- In November 2007, the Turkish Energy Market Regulatory Authority (EMRA) accepted 751 WPP applications with total capacity of 78,000 MW.
- The Turkey's Parliament approved a new law related to feed-in tariff incentives that are applied for Renewables on 29 December 2010.



Type	Feed-in Tariffs (USD Cent / kWh)	If Production Manufactured Domestically	Additional Feed-in Contribution (USD Cent / kWh)
<b>Wind</b>	<b>7,3</b>	Blade	0,8
		Generator and power electronics	1,0
		Turbine tower	0,6
		Entire mechanical components within rotor and nacelle groups	1,3



NOVEMBER 1<sup>ST</sup> 2007



## Before Nov. 2007

Singular WPP applications and licensed separately

**3500MW** of Wind capacity allocated before 2007

## Nov. 2007

### Applications

722 applications with 78.000 MW capacity  
Overlapping, or same region.

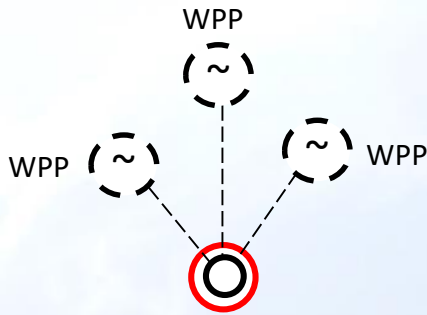
## ASSESSMENT OF APPLICATIONS

- Integration of wind capacity equal to 25% of maximum total demand is planned to be integrated. ( $48.0000/4 \approx 12.000$  MW)
- Wind Basin Substations are planned in region with high wind energy potential.
- WPP applications are directed to nearest substations.
- Maximum capacity connectable to a connection point is determined to be %5 of the Short Circuit MVA

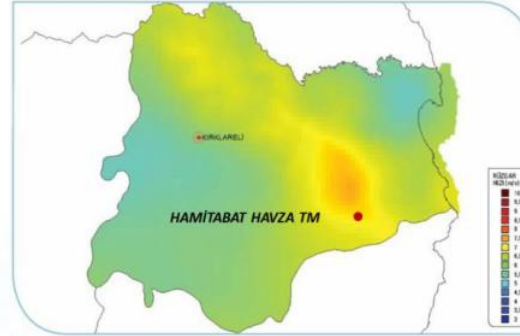




In region where wind potentials are high, Wind Basin Subs are planned to be established and connectable WPP capacities are announced by TEİAŞ to integrate WPP's.



**400/154 kV  
Basin (Collector)  
Substation**



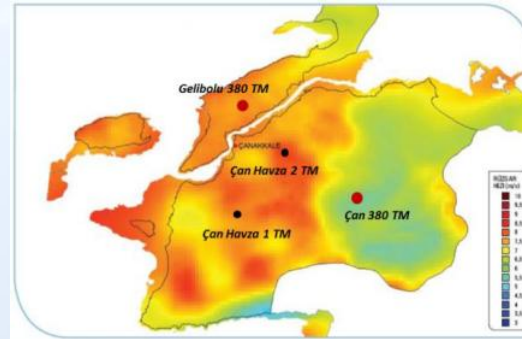
**KIRKLARELI**

380/154 kV Basin Substation



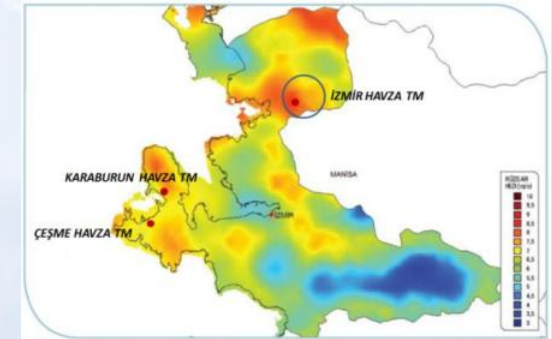
**İSTANBUL**

380/154 kV Çatalca Basin TM



**ÇANAKKALE**

380/154 kV Çan TM  
380/154 kV Gelibolu (Sütlüce) TM  
154 kV Çan Basin 1 TM  
154 kV Çan Basin 2 TM

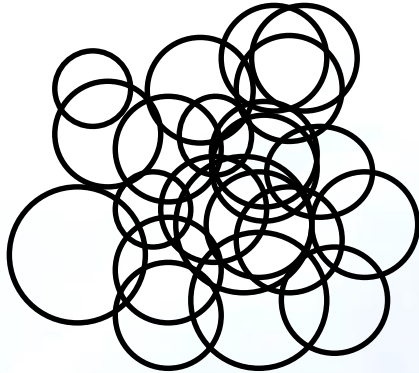


**İZMİR**

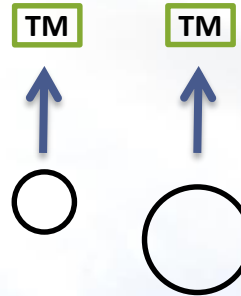
380/154 kV İzmir Basin TM



Nov. 2007  
Applications

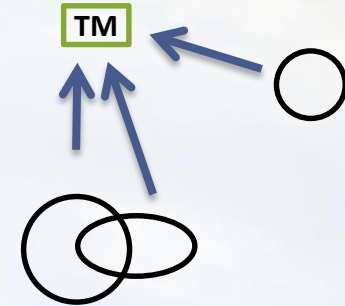


78.000 MW  
is decreased to  
7.500 MW



Non-overlapping applications to different substations are classified as singular application and connections approved.

No competition  
2000 MW



Applications that are overlapping or/and have connection request to same substation are assessed via competitions (bidding process) according to contribution fees.

via competitions  
5500 MW





***REGULATION REGARDING THE SELECTION PROCESS FOR  
MULTIPLE WIND PROJECT APPLICATIONS***

- This regulation defines competition process, obligation of investors who will attend the competition and Contribution Fee Wind and Solar Power Plant in the case of more than one power plant project application for the same region.



Connection capacities on regional basis are announced by TEİAŞ.

**After 16 months** WPP Pre-licence applications are submitted to EMRA

The applications are reviewed by General Directorate of Renewable Energy and then assessed for connection points by TEİAŞ.



The applications are listed by regions. In regions with application exceeding announced capacity, competition (tendering) is required.





- 3,000 MW capacity was announced for wind power plants on regional basis on November 2013.
- Applications for that 3,000 MW capacity were taken by EMRA at end of the April 2015.
- Energy investors have installed 1,400 measurement stations for the capacity.
- Projects, total of 42.000 MW, applied for that capacity.
- Capacity competitions (Auctions) are expected to be realized between end of 2015 and mid-2016.





- 2000 MW capacity was announced for wind power plants in April 2015 on regional basis as 2013 capacities.
- Applications for that 2000 MW will be taken by EMRA in Oct. 2016 after necessary wind site measurements by applicants.



- Connection requirements for Wind Power Generations are defined in the Appendix-18 of the Turkish Grid Code.
- Issues covered in **Appendix-18**:
  - Fault Ride Through Capability
  - Active Power Control
  - Frequency Contribution Of The Wind Power Plants
  - Reactive Power Capacity
  - Reactive Power Support
  - Monitoring Of Wind Power Plants



- In the previous grid code, a capacity up to 5 % of the system short circuit MVA at the connection point is permitted.
- According to new regulation that has been published in **January 2013**, *IEC 61400 standard* is applied to determine wind power capacity that can be connected to busbar.







# Thank you!

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